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FRUA AND DWEET

Two New Citrus Varieties That Produce Good-sized Fruit with Tangerine-like Flavor

HOWARD B. FROST JAMES W. CAMERON

CALIFORNIA AGRICULTURAL EXPERIMENT STATION • THE COLLEGE OF AGRICULTURE UNIVERSITY OF CALIFORNIA • BERKELEY

The fruits described here

are new citrus varieties—hybrids selected from many experimental crosses with the Dancy tangerine. The crosses were made at the University of California Citrus Experiment Station at Riverside, with the aim of securing larger fruits that would have a tangerine-like flavor.

Frua is essentially a tangerine, with larger and earlier-ripening fruit than Dancy. Dweet has fruit of orange size and is usable mainly for juice. Both varieties have excellent, tangerine-like flavor; both do best in the navel orange districts of southern California.

Plantings

of either variety should, at present, be on an experimental basis only, or in home gardens. Budwood is now available at the Citrus Experiment Station. It can now be distributed in some parts of the quick-decline quarantine area, and should soon be available from trees located outside of this area.

Color photographs

of both Frua and Dweet appear on pages 6 and 7 of this bulletin. Frua is described in detail starting on page 3; the description of Dweet begins on page 5. Botanical descriptions of both varieties may be found starting on page 9.

The Authors:

Howard B. Frost is Associate Plant Breeder, Emeritus, in the Experiment Station, Riverside.

James W. Cameron is Assistant Geneticist in the Experiment Station, Riverside.

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Two New Citrus Varieties That Produce Good-sized Fruit with Tangerine-like Flavor

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FOR SOME YEARS the main efforts of the citrus breeding program at the Riverside Experiment Station were applied to the production of hybrids between species within the botanical genus *Citrus*. Many hybrids, for example, were produced from crosses between orange and tangerine and between grapefruit and mandarin. In this crossing, the Dancy tangerine was used extensively as a parent with the special aim of securing larger fruits that would have a tangerine-like flavor.

Among the hybrids obtained are Frua (pronounced froo′-uh) and Dweet (the name made up from Dancy and Mediterranean Sweet). The Frua is essentially a tangerine, with larger and earlier-ripening fruit than the Dancy. The Dweet has fruit of orange size, usable mainly for extracted juice; its usual season is from February or March through May or June. These varieties have excellent flavors, much like that of the Dancy. They have proved popular with consumers in small-scale marketing, and seem to deserve wider trial. Both varieties have been found to succeed in navel-orange districts—Frua at Riverside, and Dweet both at Riverside and in Tulare County. They are not successful in the hotter climate of the Coachella Valley. No evidence on either variety is available from coastal counties, but they are to be expected to ripen later in these localities, and it would not be surprising if they were to have smaller fruit.

Plantings of either of these varieties should at present be on an experimental scale only or in home gardens.

The Frua tangerine—probably best adapted to navel-orange districts

The name Frua is the Esperanto word for 'early'; it is taken from the German *früh*.

Frua is a hybrid variety, produced by pollination of the King with the Dancy. The Dancy is the old commercial tangerine of Florida and California. The King is a larger-fruited variety with rough rind, which is probably of hybrid origin, perhaps a tangor from crossing of sweet orange with mandarin. It is commonly called "King orange" or "King mandarin," and has been grown to some extent commercially in Florida and Texas, but very little in California. The present description of the Frua is based almost entirely on trees and fruits grown at the University of California Citrus Experiment Station at Riverside.

Trees of Frua, and of Dancy and King, were planted in 1920 to 1922 and again in 1930 to 1936; bearing trees have been available for study since 1924. Frua trees have been grown on the following rootstocks: trifoliate (4), sour orange (3), and grapefruit, Cleopatra mandarin, and Cunningham citrange (1 each). Dancy and King trees are or have been available for comparison on trifoliate, sour orange, Rough lemon, and sweet orange (King only). One nucellar seedling of each of the three varieties has also been grown on

its own roots. (Nucellar seedlings arise from maternal tissue only, and repeat the seed-parent type.)

The two original Frua trees (see table 1, below) were considerably smaller than comparable Dancy and King trees. The later-planted Frua trees are now similar in size to Dancy and King of similar age, as indicated by measurement of trunk circumference and inspection of top volume. In general condition the Frua is much like the King; both have had considerable dead outer "brush," while the Dancy has practically no dead twigs except in heavy shade. This dying back of smaller branches may have been due to scarcity of nitrogen (during the period of war shortage) as well as to heavy yields and some susceptibility to injury by scale-spray oil. The trees have improved considerably in the last five years and are now mainly in good condition.

Of the rootstocks used, the Frua has succeeded best on grapefruit (variety unknown), Cleopatra mandarin, and sour orange. On trifoliate, and especially on Cunningham citrange, the trees have been smaller and poorer. Presumably sweet orange would succeed as a stock, but it has not been tried. The low seedling thorniness of the Frua and the scarcity or absence of gametic (sexually produced)

Table 1. SIZE AND COMPOSITION OF FRUITS OF FRUA TANGERINE AND ITS POLLEN PARENT, DANCY TANGERINE, AT RIVERSIDE, CALIFORNIA

Variety and rootstock*	Harvest dates	Number of trees	Number of fruits	Weight per fruit (grams)	Per cent of juice in fruits	Composition of juice		
						Per cent soluble solids	Per cent citric acid	Ratio of solids to acid
Frua (T)	Nov. 25, 1925	2	20	104	46.0	11.6	1.16	10.0
Dancy (T)	Nov. 25, 1925	1	20	71	45.1	12.6	1.71	7.3
Frua (T)	Dec. 6, 1926	1	20	94	47.8	12.2	1.31	9.3
Dancy (T)	Dec. 6, 1926	2	40	85	50.5	12.9	1.52	8.5
Frua (T)	Dec. 27, 1927	1	20	98	47.4	11.8	1.06	11.1
Dancy (T)	Dec. 27, 1927	3	60	100	49.7	12.3	1.27	9.6
Frua (T)	Dec. 10, 1928	2	40	81	48.4	12.0	1.15	10.4
Dancy (T)	Dec. 10, 1928	2	40	70	46.6	13.7	1.50	9.1
Frua (T)	Jan. 10, 1929	2	20	81	48.9	13.3	1.09	12.2
Dancy (T)	Jan. 10, 1929	1	20	62	48.6	15.0	1.46	10.3
Average:†								
Frua (T)	1925–29	2	120	94	47.5	12.0	1.16	10.4
Dancy (T)	1925–29	5	180	81	48.2	13.0	1.50	8.8
Frua (S)	Jan. 11, 1950	2	40	100	46.7	11.8	1.13	10.4
Frua (Cp)	Jan. 12, 1950	1	20	108	43.0	10.6	1.14	9.3
Frua (T)	Jan. 11, 1950	2	40	103	45.1	12.2	1.26	9.7
Frua (Cn)	Jan. 12, 1950	1	20	80	40.6	11.7	1.54	7.6
Dancy (S)	Feb. 27, 1950	1	20	64	45.8	16.2	1.54	10.6

* In the years 1925 to 1929 all trees were in three adjacent short rows, planted at a distance of 5 x 12 feet. In the year 1950, trees at distance of 20 x 24 feet. Rootstocks: S, sour orange; T, trifoliate (alternating with sour; both planted in 1930). Other stocks (distant from S and T): Cp, Cleopatra mandarin; Cn, Cunningham citrange.
† These are averages of the annual averages for this period.

seedlings are favorable to the practical success of unbudded nucellar seedlings, and a further trial of these has been started.

The Frua fruit is very similar to that of the Dancy in color, ease of peeling, and flavor. At Riverside it is considerably larger and ripens earlier. Table 1 shows a comparison of Frua and Dancy fruits during the Frua season in several years. During December and January the Frua regularly has a moderate acid content and a satisfactory content of soluble solids (about 12 per cent), while the Dancy, although higher in solids on the same sampling dates, usually is unpleasantly sour until late January or February.

Frua fruit has averaged appreciably larger than Dancy in almost every season. For the analyzed samples the general mean was 16.0 per cent. or nearly 1/6, larger. The sample, usually 20 fruits, was representative for size and position on the tree. The seediness of the Frua has averaged slightly less than that of the Dancy, so far as counts have been made. The Cunningham citrange rootstock may unfavorably influence fruit characters of the Frua, as well as its vigor as mentioned above. According to the data obtained in 1950 (table 1) the fruits on this rootstock were smaller and much higher in acid than on other stocks.

Defects of the Frua are the rather low vigor of the tree, its inability to produce a crop under hot desert conditions, and the short season of the fruit. However, it is an especially early variety, and is harvested before the Washington Navel reaches its best quality.

It seems best adapted to the southern navel-orange districts. It has been tried in one foothill location near Porterville, where it gave only light yields.

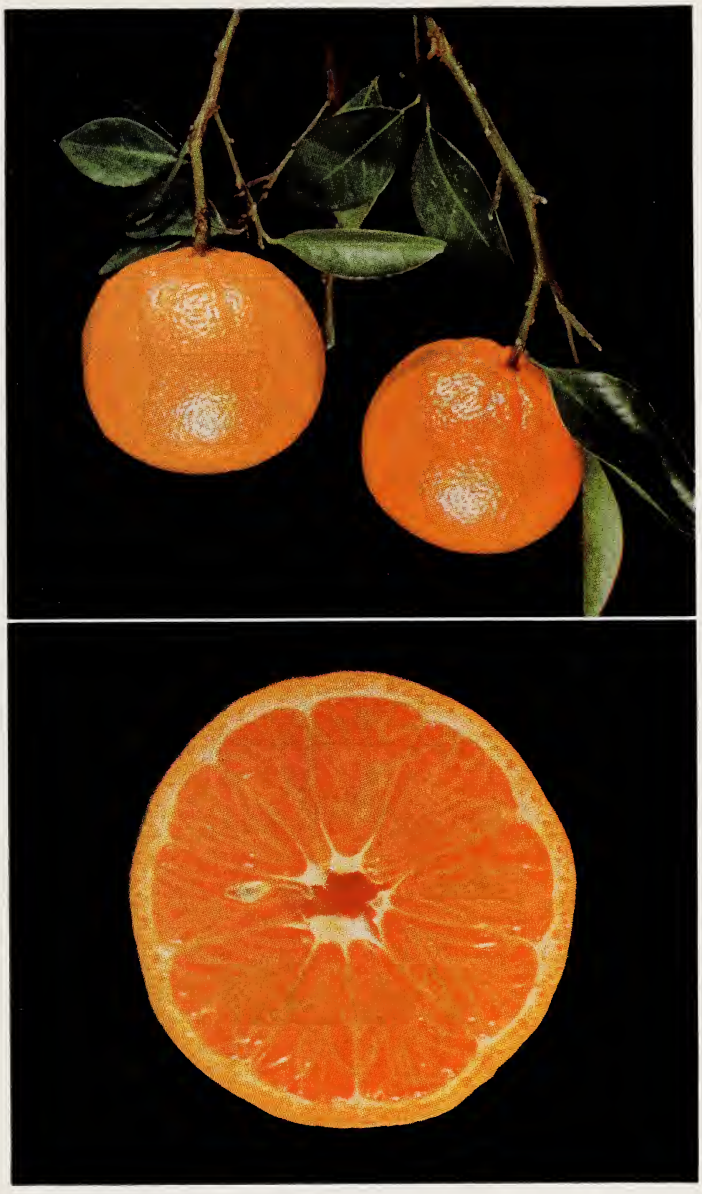
The Dweet tangor*—so far yields have been fair

Plant breeders of the United States Department of Agriculture have given the name tangor (from *tang*erine and *or*ange; pronounce to rhyme with Bangor) to hybrids between tangerine or mandarin and sweet orange. They have introduced one tangor variety, the Umatilla, a hybrid of Satsuma and orange. The Temple "orange," which is grown commercially in Texas and is being tested in several places in the Coachella Valley, is probably a tangor, although its origin is not known. So also is the King "orange" or "mandarin." Many new seedling tangors have been originated in recent years. There are great differences among them, even from the same two parent varieties, and a few of them combine orange size with new and excellent flavors.

Tree. The Dweet tangor* is a hybrid originated at the University of California Citrus Experiment Station at Riverside, in 1915. The female or seed parent was the orange variety usually known as Mediterranean Sweet in California; the male or pollen parent was the Dancy tangerine.

The Dweet has been fruited on sour-orange and Cleopatra-mandarin rootstocks; since it might prove to be susceptible to quick decline on sour stocks, presumably sweet orange or Cleopatra should be used. It is now being tested on sweet orange and trifoliate orange. The description which follows is based mainly on the four bearing trees at Riverside, with some evidence from others.

* The name Dweet is made up from parts of the names Dancy and Mediterranean Sweet. As H. J. Webber states in *The Citrus Industry*, Volume I, two orange varieties have been called Mediterranean Sweet in the United States. The one here considered, which was formerly grown commercially in California and Florida, is described by Dr. Webber under its Florida name, Maltese Oval.



This is Frua, photographed in actual color. The whole fruits above are about one-half actual size; the cut fruit is about actual size.

Frua and Dweet ... two new citrus varie

This is Dweet. Here too, the whole fruit above is about one-half actual size, and the cut fruit below is about actual size for this variety.

of good size, with tangerine-like flavor

Fruit. The Dweet has tender-fleshed, extremely juicy fruit of orange size, somewhat egg-shaped or pear-shaped, and usually with a short, irregular neck. It is probable that if grown near the coast the fruits would be shorter and less necked. The juice is very easily extracted and has a pleasant flavor similar to that of the tangerine parent. The fruit peels easily but the segments are rather too tender for eating out of hand. Table 2 below gives data for Dweet fruits in three years, and for the orange parent in 1950. (See table 1 on page 4 for analyses of the tangerine parent.)

The average fruit weights shown for the Dweet, of 119 grams in 1949 and 141 grams in 1950 (from the tree on sour stock) are representative for trees with medium to heavy crops. The larger fruits recorded for 1950 and 1925 were from trees with light crops.

In 1950, which was an unusually late season for maturity of citrus, the soluble solids and citric acid of the Dweet were well balanced at the sampling on May 3. Ordinarily the fruit is good considerably earlier and would be low in acid by June, as shown for 1949. Its season of use is similar to that of the Mediterranean Sweet orange parent and just precedes the main Valencia season. In content of juice and in proportions of acid and solids, it is similar to the orange parent, and to the Valencia in early summer; the characteristic difference is in the tangerine-like aroma of the juice, and in its unusual ease of extraction.

The size and quality of the Dweet should make it a good home-use variety if yields are satisfactory. At Riverside, where it has shown the most promise, and at two locations in Tulare County, yields have been fair, although they may not be adequate for commercial production because of a tendency to splitting of the fruit and considerable alternation in bearing. This variety, like the Frua, is not successful in hot desert areas.

The Dweet produces much of its fruit at the ends of long twigs, outside the foliage. This exposure of the fruit makes it relatively unsuited to planting in windy or cold locations.

Table 2. SIZE AND COMPOSITION OF FRUITS OF DWEET TANGOR AND ITS SEED PARENT, MEDITERRANEAN SWEET (MALTESE OVAL) ORANGE, AT RIVERSIDE, CALIFORNIA

Season and rootstock*	Harvest dates	Number of trees	Number of fruits	Weight per fruit (grams)	Per cent of juice in fruits	Composition of juice		
						Per cent soluble solids	Per cent citric acid	Ratio of solids to acid
				Dweet Tangor				
1925 (T)	March 24	1	8	244†	50.2	13.2	1.66	8.0
1949 (S)	June 6	1	10	119	50.1	12.5	0.65	19.2
1950 (Cp)	May 3	1	20	250†	48.4	13.5	1.22	11.1
1950 (S)	May 3	1	20	141	46.4	15.3	1.33	11.5
				Mediterranean Sweet (Maltese Oval) Orange				
1950 (S)	April 5	1	20	137	46.1	13.8	1.26	11.0
1950 (S)	April 5	1	20	117	44.4	13.9	1.02	13.6

* Rootstocks: T, trifoliate; Cp, Cleopatra mandarin; S, sour orange.
† From trees with light crops.

Here is a botanical description of the Frua tangerine

Tree somewhat variable and irregular in shape; **outline** approximately short-ellipsoid or globose; **foliage** considerably less dense than Dancy. **Branches** mostly ascending to erect, except often drooping near ground. Branches and twigs numerous but considerably less numerous and less slender than Dancy. Dead twigs common, mainly where shaded; some outer branches dead.

Leaves typically of medium size, similar to King and moderately larger than Dancy, sometimes small on part of the branches subsequent to partial defoliation, especially with trifoliate and Cunningham rootstocks. Largest leaves with blade about 9 to 10½ centimeters (3½ to 4¼ inches) long by about 5 to 6 centimeters (2 to 2½ inches) wide; medium-sized leaves 2 to 3 centimeters shorter and 1 to 2 centimeters narrower. **Petioles** short, mostly 7 to 14 millimeters (5/16 to 5/8 inch) long.

Leaf blade elliptical; base acute to slightly acuminate; estimated average basal angle 60°; **apex** slightly to moderately acuminate; width, margin, and single median indentation of tip about like Dancy; margin very finely and not very closely serrulate. **Normal leaf color** about like Dancy; very little mottling in April, 1950, except on the tree on Cunningham stock.

Fruit ripening at Riverside about three to four weeks earlier than Dancy, although difference in time of coloring may average nearer two weeks; usually good by January 1 and in some years near December 1. **Season** short, especially for market, since fruits become puffy soon after ripening.

Fruit size between Dancy and King, analyzed samples averaging about 70 to 115 grams per fruit, or about 4 to 6½ fruits per pound (comparable Dancy, 60 to 110 grams per fruit). **Fruit shape** variably oblate, good to fair; often narrowly collared; neck usually absent but occasionally slight (averaging much less than Dancy). Fruit more angled and furrowed than Dancy, often deeply furrowed at base; apex slightly to moderately basined.

Rind surface shallowly pitted and grained, occasionally moderately bumpy but much less so than King. **Rind color** deep orange to red-orange, Ridgway's* 10h to 9h or 11h; about like Dancy but somewhat more variable. **Rind thickness** about 2 to 3½ millimeters, somewhat thicker than Dancy but considerably thinner than King; rind peeling very easily. **Oil glands** mostly not conspicuous on surface, but very numerous. Oil abundant, aroma similar to Dancy but more pleasant.

Core slender, much smaller than in King or Dancy, becoming hollow in mature fruits. Fruit puffing earlier and more rapidly than Dancy as a result of marked overgrowth of the flavedo, or colored layer of the rind. **Segments** mainly 10 or 11, often 9 or 12, separating easily. Segment walls thin, about like Dancy and thinner than King, rather tough.

Pulp color deep orange to yellow-orange, Ridgway's 12h to 14i, slightly deeper than Dancy. **Pulp vesicles** medium in size, moderately stout, usually tender. Pulp very juicy; juice usually 45 to 48 per cent of weight of fruit, averaging slightly less than Dancy because of the thicker rind.

Soluble solids 10.5 to 12.5 per cent in the main season, averaging slightly less than Dancy. Acid usually 1.0 to 1.3 per cent during the same period. Solids-acid ratio moderately higher than Dancy until late in the season.

Aroma of juice pleasant, similar to Dancy but somewhat less strong. Flavor and texture very good; sweeter than comparable Dancy in the main season of Frua (maximum flavor less rich than Dancy but attained earlier).

Seeds small, averaging slightly smaller than in Dancy; rather stout; external color cream, often tinged with green; cotyledons pale green, or part of them yellowish or whitish (they are green in Dancy, but yellowish in King). Seeds averaging about 9 to 13 per fruit; ten counts, for a total of 190 fruits, give a mean of 10.3 as compared with 11.9 for 160 Dancy fruits. (These counts include the empty seed coats, averaging about 0.5 and 0.7 per fruit.) The Frua therefore appears to be slightly less seedy than the Dancy under Riverside conditions.

* Ridgway, Robert. Color standards and color nomenclature. Published by the author, Washington, D.C., 1912.

And here is a botanical description of the Dweet tangor

Tree (in all districts) large, vigorous, about as tall as broad, or taller. **Branches** moderately spreading and rather open, but foliage heavy; appearance orange-like, but much less dense and drooping than the dwarfish Mediterranean Sweet, and more like the Valencia; twigs rather stout, moderately numerous. Fruits largely outside the foliage, often at the ends of long twigs, thus rather susceptible to injury by wind and frost. The Dweet is therefore unsuited to planting in especially windy or cold locations.

Leaf blades elliptical, with acute base and acuminate apex; size large for orange, the larger ones about 10 to 15 centimeters (4 to 6 inches) long by about 4 to 6½ centimeters wide. **Petioles** long, commonly about 10 to 25 millimeters (⅜ to 1 inch); petiole wings usually extremely narrow or only a trace.

Fruit size similar to that of the Valencia orange, or somewhat less, and fairly uniform. Trees do not set excessive numbers of fruits, and therefore maintain good size even with heavy yields.

Fruit shape fair to good, and similar in all localities where tried. Shape is commonly short obovoid or short pyriform; slightly oblique; usually having a very short, often irregular neck. Base and apex variably furrowed, apex somewhat basined. **Rind surface** much like that of oranges, but often somewhat rough or bumpy.

Rind color yellow-orange and orange-yellow (Ridgway, about 13h to 15h), much like that of the Valencia. Overripe fruits may become greenish.

Rind thickness medium to rather thin (about 6 to 3 millimeters, perhaps averaging about 3/16 inch). Rind peels readily with only a moderate amount of the white albedo adhering to segments. Fruit solid to nearly so; when overripe, rind slightly to moderately puffed, and axis (core) only moderately hollow.

Oil glands of rind very numerous, medium-sized, moderately conspicuous on surface. Oil abundant. Odor of oil similar to that of the Dancy, very pronounced, and sometimes unpleasant, at least to some persons.

Fruit segments usually 9 to 11, separating with some difficulty; segment membranes tough. **Pulp vesicles** rather large and stout, very tender and extremely juicy. Acid higher early in the season than in mature oranges; sugar medium; flavor sour early in season (but very good with added sugar), becoming sweet (see table 2). **Juice aroma** (odor) pronounced, similar to that of Dancy; good to very good. **Flavor** good to very good. Juice very easily extracted but pulp too tender for convenient handling by segments; the rind oil should be avoided.

Seeds small, plump, usually stout; similar to Dancy but size probably usually larger and beak much shorter; medium in number; averages of four counts, 12.4 to 19.0 per fruit. Nursery seedlings of Dweet which have been grown have evidently been nearly all nucellar. Season at Riverside, February or March to May or June; fruits sometimes good even later in summer.

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